B.Sc. Civil Technology

1st SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CTMA-101	Applied Mathematics	3	0	3	0
CT-102	Fundamentals of Computing	2	1	2	3
CTHU-103	Communication Skills – I	0	1	0	3
CTM-104	Engineering Geology	2	1	2	3
CT-105	Mechanics of Materials	2	1	2	3
CT-106	Professional Ethics	2	0	2	0
	Total:	11	4	11	12
		15		23	

2nd SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CT-107	Materials and Methods of Construction	2	1	2	3
CT-108	Fluid Mechanics	2	1	2	3
CT-109	Surveying	3	2	3	6
CTIS-110	Islamic and Pak Studies/ Ethics	2	0	2	0
CT-111	Technical Drawing	2	2	2	6
CT-112	Practical Field Training and Report Submission-I	0	2	0	6
	Total:	11	8	11	24
		19		35	

3rd SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CTMA-201	Statistics and Numerical Methods	3	0	3	0
CTHU-202	Communication Skills – II	0	1	0	3
CT-203	Surveying and Application of GIS in Civil Technology	2	2	2	6
CT-204	Concrete Technology – I	2	1	2	3
CT-205	Structural Mechanics	3	1	3	3
	Total:	10	05	10	15
		15		25	

4th SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CT-206	Soil Mechanics	3	1	3	3
CT-207	Hydraulic Machinery	3	1	3	3
CTEN-208	Water Supply and Waste Water Management	2	1	2	3
CT-209	Quantity Surveying and Contract Documents	2	1	2	3
CTIS -210	Islamic and Pak Studies/ Ethics	2	0	2	0
CT-211	Practical Field Training and Report Submission-II	0	2	0	6
	Total:	12	06	12	18
		18		30	

5th SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CT-301	Soil Investigations	3	1	3	3
CT-302	Hydrology	3	1	3	3
CT-303	Bridge Technology	3	1	3	3
CT-304	Concrete Technology – II	3	1	3	3
CT-305	Engineering Economics	3	0	3	0
	Total:	15	04	15	12
		19		27	

6th SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CTEN-306	Environmental Management	2	1	2	3
CTAR-307	Introduction to Architecture and Town Planning	3	0	3	0
CT-308	Steel Structures	3	1	3	3
CT-309	Renewable Energy Resources	2	1	2	3
CT-310	Practical Field Training and Report Submission-III	0	2	0	6
	Total:	10	05	10	15

		15	25

7th SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CT-401	Disaster Management	3	1	3	3
CT-402	Transportation Engineering	3	1	3	3
CT-403	Water Resources Engineering	3	1	3	3
CT-404	Computer Applications in Civil Technology	2	1	2	3
CT-405	Project Management	2	1	2	3
	Total:	13	5	13	15
		18		28	

8th SEMESTER

Course No.	Subject	Credit Hours		Contact Hours	
		Theory	Practical	Theory	Practical
CT-406	Repair and Maintenance of Structures	2	1	2	3
CT-407	Pavements and Foundations	3	1	3	3
CT-408	Pre-Stressed and Pre-Cast Concrete Technology	3	1	3	3
CT-409	Project	0	4	0	12
CT-410	Practical Field Training and Report Submission	0	2	0	6
	Total:	08	09	08	27
		17		35	

Grand Total for four years

G. Total		136	220

CURRICULUM OF B-TECH. (CIVIL TECHNOLOGY)

DETAILS OF COURSES

1st SEMESTER

CTMA-101   APPLIED MATHEMATICS

i-　　To review the knowledge and practice the skills acquired in diploma courses.

ii-　　To understand the concept and use of differential equations.

iii-　　To learn different methods to solve differential equations.

iv-　　To understand the concept of complex numbers and their applications.

Description

A significant part of the course relates to the review of previous studies. The course aims at the learning of different mathematics skills and their applications in solving technical problems.

Contents

1.　　Review of the following:　　　　　　　　　　(5 weeks)
   - Integral Calculus
   - Differential Calculus
   - Matrices and Determinant
   - Vector Algebra
   - Analytical Geometry

2.　　Introduction to Differential Equations　　　　(4 weeks)
   - Basic Concepts
   - Geometric Interpretations
   - Separable Equations
   - Exact Differential Equations
   - Linear First Order Differential Equations
   - Bernoulli's Differential Equations
   - Families of Curves
   - Applications

3.　　Higher Order Differential Equations　　　　　(2 weeks)

   - Homogeneous Linear Equations of Second Order
   - Non- Homogeneous Equations

- Application of Higher Linear Differential Equations

4.   Partial Differential Equations   (2 weeks)
- Basic Concepts
- Solution by Separable Variables
- Classification

5.   Complex Numbers   (2 weeks)

- Invented Number Systems
- The Argand Diagram
- Complex Variables
- Derivatives
- Complex Series
- Applications

Text Books:

1.   Thomas G. B. and Finney R. L. CALCULUS AND ANALYTIC   GEOMETRY (latest edition).

Reference Books:

1.   Kreyszig E. ADVANCED ENGINEERING MATHEMATICS. John Wiley and Sons, USA (latest edition).

2.   Cohen H. L. MATHEMATICS FOR SCIENTISTS AND ENGINEERS. Prentice-Hall, UK (latest edition).

CT-102   <u>**FUNDAMENTALS OF COMPUTING**</u>

Objectives:
i-   To review the knowledge and practice the skills acquired in diploma courses.

ii-   To practice the use of BASIC language and Spreadsheet software in different applications.

iii- To learn the concept of CAD/CAM and related applications.

iv-   Familiarization with commercially available software in the relevant field.

Description:
This course intends to enhance the knowledge of students regarding computer applications and to provide them a chance to get hands-on exposure to different general purpose and special purpose computer applications.

Contents

1 Review of the following knowledge/skill   2 weeks

- Electronic Data Processing
- Operating System
- BASIC language

2 Practice in using Word Processing Software   3 weeks

- Character and Paragraph Formatting.
- Tables and Columns
- Page Setup and Print Setup
- Inserting Objects
- Styles, Index and TOC
- Customization

3 Practice in using Spreadsheet software   3 week

- Data Types
- Entering and Editing data
- General Calculations
- Statistical Analysis
- Graphics

4 CAD/CAM Applications (Technology Related)   3 weeks

5 Familiarization with Commercially available software in the relevant field   4 weeks

Text Books:
1. Gottfried R. S. PROGRAMMING WITH BASIC. Schaum's Outline Series (Latest Edition).
2. User's Manuals for Word Processing software, Spreadsheet software and technology specific software

Reference Books:
1. Tucker A. B., Bernat A., Cupper R. D. and Scragg G. W. FUNDAMENTALS OF COMPUTING. McGraw Hill Book Company (Latest Edition).
2. IBM DICTIONARY OF COMPUTING (Latest Edition).
3. Bradley J. C. QUICK BASIC. Wm. C. Brown Publishers, USA (Latest Edition).

CTHU-103   **COMMUNICATION SKILLS-I**

Objectives:

i- To understand the importance and basic concepts of communication.

ii- To enhance the listening skills and to become active listener.

iii- To enhance the reading skills and to become active reader.
iv- To improve the writing skills in general.

This course is based upon lectures, group discussions, case studies and practice sessions.

Contents:

1. **Introduction to Communication**   (2 weeks)
    - Importance, Theories, Barriers, Components

2. **The Seven C's for Effective Communication**   (3 weeks)

3. **Listening Skills**   (2 weeks)
    - Blocks, Thinking and Feeling
    - Notes Taking
    - Giving Feedback

4. **Reading Skills**   (2 weeks)

    - Active Reading Techniques
    - Skimming, General Reading and Careful Reading

5. **Introduction to Writing Skills**   (3 weeks)
    - Planning
    - Drafting and Editing
    - Emphasis and Connections

6. **Grammar and Vocabulary**   (3 weeks)
    - Technical and Business Vocabulary
    - Constructing Formal Sentences

Text Books:

1. Murphy H. A., Hildebrandt H. W. and Thomas J.P. EFFECTIVE BUSINESS COMMUNICATIONS. McGraw-Hili, USA(Latest Edition).

Reference Books:

1. Norman S. WE'RE IN BUSINESS. Longman Group Ltd., UK (Latest Edition).
2. Thomson A. J. and Martinet A. V. A PRACTICAL ENGLISH GRAMMAR. Oxford University Press, UK (Latest Edition).

CTM-104   <u>**ENGINEERING GEOLOGY**</u>

Objectives:

i-   To understand geology or various minerals and rocks and their properties.

ii-   To learn to select proper site for civil engineering structures.

Contents

1 **Introduction.** Introduction to Geology. Importance of Geology in civil engineering projects. Sedimentary, igneous and metamorphic rocks. Volcanic activity. Internal structure of the Earth. Engineering and physical properties of rocks. Identification of common rock forming minerals.

(3 Weeks)

2 **Classification of Rocks and Minerals**. Color of grain with respect to rock color Chart of Geological Society of America. Identification of grains (coarse, medium and fine) of sedimentary rocks. Hardness classification (very soft, soft etc) with respect to simple field tests and uniaxial compression strength. Identification of rocks by megascopic studies. Identification of subordinate constituents in rock samples.   (4 Weeks)

3 **Structural Geology**: Introduction to structural Geology and plate tectonics. Causes and effects of earthquakes. Protective measures against earthquakes. Sequence and principles of stratigraphy, earthquake zoning for Pakistan. Land-sliding and its causes. Hydrogeology: wells, springs, streams and ground water conditions. Causes of glaciers and their types.

(4 Weeks)

4 **Geology in Civil Technology**: Role of geology in selection of sites for dams, reservoirs, tunnels and other important civil engineering structures, such as highways, airfield and bridges. Ground subsidence: Mining subsidence due to alteration of fluid levels. Methods of avoiding mine collapses. Introduction to blasting. Engineering geology of tunnels, geological survey prior to tunneling, lining of tunnels and its section. Selection of tunnel site and its requirements, case histories, brief introduction to local geology.

(4 Weeks)

Practicals:

1.   Identification of minerals

2. Identification of igneous, sedimentary and metamorphic rocks 3. Determination of specific gravity
4. Determination of hardness of rock
5. Determination of uniaxial compressive strength
6. Determination of rock quality designation (RQD)
7. Study of different geological structures
8. Stereo plotting (for slope stability)
9. Shear strength determination of rock joints
10. Point load test
11. Slake durability test
12. Tensile strength

Books Recommended:

1. A Geology for Engineers, Blyth, F G H 7th Arnold International student edition.
2. Geology and Engineering, Legget, R F 3rd edition McGraw Hill International edition.
3 Principles of Engineering Geology and Geotechniques, Krynine, DP 1st Edition McGraw Hill International edition.

CT-105   MECHANICS OF MATERIALS:

Objectives:

i) To develop an understanding of analysis of the magnitudes and distribution of internal forces in the body by the concept of free body diagram under external loads.

ii) To develop the concepts of mechanics of deformable bodies. To calculate the internal forces and deformations and to establish the intensity of each as a function of applied loads.

iii) To develop an understanding of structural behavior of different materials, their modes of failure and the stresses appearing at different stages.

Description:

The course presents an understanding of the behavior of various forms of structure including stresses and deflection in beams. It further explains the basic approach to Energy Methods. The developed analysis tools will be used later to understand all the design concepts.

Contents:

1. **Review of Vector Mechanics, Types of Supports and Loads:** General case of forces in a plane. Roller, hinge, fixed supports, concentrated, uniformly distributed and uniformly varying loads.

(1 Weeks)

2. **Stresses and Strains in Deformable Bodies:** Axial loads, normal stress, shearing stresses, bearing stresses, stresses in compound bars, temperature stresses and relationship between elastic constants. Geometrical properties of plane figures including moment of inertia about centroidal and parallel axis. Stress, strain, modulus of elasticity, poisons ratio. Stress & strain graph for a mild steel specimen showing different stages of the curve.

(2 weeks)

3. **Resistive Forces:** Types of loads, beams, supports and reactions. The construction of shearing force and bending moment diagrams for determinate beams under different loads. Relationship between load, shear force and bending moment.

(2 weeks)

4 **Flexural Behavior of Beams:** Theory of simple bending, derivation of flexural formula $M/I = f/y = E/R$. Flexural and shear stress distribution in different beam cross-sections. Construction of equation of horizontal shear stress, shear stress distribution in various sections.

(2 weeks)

5. **Transfer of Torque in Structural Members:** Theory of torsion in circular shafts. Derivation of torsion equation $\tau/r = T/J = G.\theta/L$ and its application to solid and hollow circular cross-sections. Approximate analysis for torsion in non-circular sections. Sources of torsion in structures.

(2 weeks)

6. **Deflection of Beams:** Concept of elastic curve and curvature diagram of the linearly elastic prismatic beam under different loading. Deflection of beams using Double Integration and Moment Area methods.

(2 weeks)

7. **Combined Stresses:** Concepts of behavior of members under bending and axial force, kern of a section.

(1 weeks)

8. **Strain Energy:** Basic approaches of Equilibrium and Energy methods. Strain energy due to direct stresses, shear, bending, torsion and suddenly applied loads.

(1 weeks)

9. **Columns:** Behavior of short and long columns. Euler's theory of buckling of long columns and other empirical formulae.

10. **Mechanical Properties:** Mechanical properties of metals and timber in tension, compression, bending and torsion. Principles of testing machines and its application in testing of metal samples.

(1 weeks)

Laboratory Tests:

1- Tensile strength of a mild steel specimen and marking different stress points upon stress strain curve. Background, theory & instruction [3], experiment [1], discussion and report [2].
2- Compression test on wooden cubes. Background, theory & instruction [2], experiment [1], discussion and report [2].
3- Bending test on wooden beam. Background, theory & instruction [2], experiment [1], discussion and report [1].
4- Hardness test on steel specimens using Avery's Rockwell testing machines. Background, theory & instruction [2], .experiment [1], discussion and report [2].
5- Charpy's Impact test on steel samples. Background, theory & instruction [3], experiment [1], discussion and report [2].
6- Verification of principle of superposition. Background, theory & instruction [2], experiment [1], discussion and report [1].

Text Books:

1. Mechanics of Materials (S.I Units) by P. P. Benham and F.V. Warnock, Edison Wesley Longman. January 1996 (Latest Edition).

Reference Books:

1. Mechanics of Materials (S. I. Version) by E. P. Popov. 2nd Edition, Printice Hall, Inc. 1976 (Latest Edition).
2. Strength of Materials by F. L. Singer. Harper & Row Publishers.
3. Engineering Mechanics by Timoshenko & D. H. Young. 4th Edition McGraw Hill (Latest Edition).

CT-106   **PROFESSIONAL ETHICS**

Duties/responsibilities of consultants, private clients / public clients, contractors, designers, material providers, reviewers, arbitrators, ets. Working atmosphere of public / private office. Boss- subordinate relationship. Cases where loss has to support

subordinates and otherwise. Cases where subordinate has to obey his loss otherwise. Protection of public money/interest. What to do in case of any fault in design, consultation or execution of project. Behavior in case of self- mistakes. Behavior when colleagues make a mistake. Various on job reasons and the correct answers. Appreciation of others achievements. Positive competition of job. Protecting the rights of subordinates. Fairness in dealings. Awareness of quality control and standards and how strictly these must be enforced. Dedication to knowledge and profession. Dealing with labor. Amenities for labor. Improving labor out put. Fair and effective management of cash flow. Duties and responsibilities of inspectors.

2nd SEMESTER

CT-107   <u>MATERIALS & METHODS OF CONSTRUCTION:</u>

Aims

a. To develop an understanding of the properties, uses and behavior of the building materials, standards for material quality, various tests on materials.

b. To develop the basic understanding of construction techniques and methods of building construction with particular reference to R.C. work, brick work, flooring, damp-proofing, roofing and stairs.

Description:

The course introduces the properties, uses, behavior and quality control of building materials with special reference to bricks, tiles, lime, cement, aggregate and concrete. A basic understanding of construction techniques and methods of building construction is also included in the course. These concepts are very essential for better understanding of construction technology and design.

Contents:

1. **Bricks, Blocks and Tiles:** Manufacture of bricks/blocks and its classifications, standard tests of bricks/blocks and characteristics of good bricks/blocks, process of manufacture of tiles. Ceramic materials.

                                                                          (2 Weeks)

2. **Stones:** Characteristics of good quality stones, dressing of building stones, properties and uses of common construction stones used in Pakistan. Location of stone queries in Pakistan.

(2 Weeks)

3. **Aggregate for Roads, Railways and Concrete:** Properties of aggregates, Los Angeles Abrasion Test, crushing strength, gradation, weathering effects, T.D.S. Constituents of concrete, its properties and different mixes recommended for constructions, effect of w/c ratio upon strength of concrete.

(2 Weeks)

4. **Water, Lime, Cement and Timber:** Qualities of water used for concrete mixes. Test and uses of lime. Methods of manufacture and storage of cement in different conditions. Classification and grading of sand and its bulking, cement sand mortars used for building construction. Characteristics, properties and performance of Pakistani timber used in construction. Seasoning and preservation of wood. Use of plywood, hard board and chipboard in construction.

(2 weeks)

5. **Paints and Varnishes:** Types of paints, Composition, preparation and application of paints, plaster, varnishes and distempers in building works.

(1 weeks)

6. **Metals:** Manufacture, characteristics and uses of Ferous and Non-Ferous metals and their alloys. Composition and uses of mild steel, cast iron, brass and aluminum in buildings.

(1 weeks)

7. **Glass and Plastics:** Composition, varieties, properties and uses of glass, plastics, laminates and adhesives in constructions. Properties and uses of asphalt, bitumen, rubber, asbestos and its products, plastic pipes, reinforced plastics.

(1 weeks)

8. **Masonry:** Bonds in brick masonry and their formation in building construction, corbel, cornice, string course, parapets and slip joints. Masonry block. Scaffolding work design and its importance in construction work. R. B. beams, columns, lintels and slab construction in buildings. ASTM Standards and testing of bricks.

(1 weeks)

9. **Construction:** Hand tools for construction. Foundation for walls and piers. Load bearing walls in brick and masonry construction, composite walls cavity construction, concrete framed structures panel walls, and external finishes. Reinforced concrete, materials in roof and floor construction, and floor finishes.

Internal walls and partitions, surface finishes to internal walls and ceiling, doors and windows, staircases, damp proofing of walls and ceiling. Fire resistant construction. Tunnel and Coffer dams construction. Formwork for slabs, beams, columns & walls, etc. and its design. Formwork for shells. Use of Gabion walls.

(2 weeks)

10.   Standards, inspection & quality control of materials.   (1 weeks)

Practical:

1-   Standard consistency test of cement. Background, theory & instruction   [2], experiment [1], discussion and report [1].
2-   Standard sizes of brick and blocks. Background, theory & instruction [1], experiment [1], discussion and report [1].
3-   Determination of water absorption of a brick. Background, theory & instruction [1], experiment [1], discussion and report [1].
4-   Determination of efflorescence of brick. Background, theory & instruction [1], experiment [1], discussion and report [1].
5-   Determination of compressive strength of brick/block. Background, theory & instruction [1], experiment [1], discussion and report [1].
6-   Determination of moisture content of wood. Background, theory & instruction [1], experiment [1], discussion and report [1].
7-   Determination of specific gravity of wood. Background, theory & instruction [1], experiment [1], discussion and report [1].
8-   Fineness of Cement. Background, theory & instruction [1], experiment [1], discussion and report [1].
9-   Fineness modulus of various sands. Background, theory & instruction [2], experiment [1], discussion and report [2].

Text Books:

1.   Materials of. Construction by R. C. Smith and C. K. Andres, ISBN: . 0070585040, McGraw Hill. January 1987 (Latest Edition).

Reference Books:

1-   Fundamental of Building Construction: Material and Methods, by Edward B. Allen, (Latest Edition).
2-   Building Construction Vol. I to Vol. IV by Mckay (Latest Edition).
3-   Building Construction by Mitchall (Latest Edition).
4-   Building Construction by Huntington (Latest Edition).
5-   Civil Engineering Materials by Neil Jackson (Latest Edition).
6-   Construction Materials by P. D. Domone, University College, London (Latest Edition).

CT-108   **<u>FLUID MECHANICS:</u>**

Introduction:
Fluid mechanics, hydrostatics, kinematics, hydrodynamics, hydraulics, solids and fluids, liquids and gases, units and dimensions.

Physical properties of fluids;
Specific weight, density, specific volume, surface tension, compressibility, viscosity, units of viscosity, measurement of viscosity, Newton's equation of viscosity.

Fluid Statics:
Pressure intensity and pressure head: pressure specific weight relationship, absolute and gauge pressure, measurement of pressure, Piezo-meter, Manometer, Pressure Transducers. Differential manometer and Bourden gauge.

Forces on submerged planes and curved surfaces and their applications. Buoyancy and floatation, Equilibrium of floating and submerged bodies.

Fluid Kinematics:
Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow. Path line, streamlines and stream tubes, Velocity and discharge, Equation of continuity for compressible and incompressible fluids.

Hydrodynamics:
Different forms of energy in a flowing liquid, head, Bernoulli's equation and its application, E.L. & H.G.L., free and forced vortex.

Flow Measurement:
Orifices and mouthpieces, sharp -crested weirs and notches, pitot tube and pitot-static tube, Venturimeter, Salt velocity method, colour velocity method, Radioisotope methods.

Steady Flow through Pipes:
Losses in pipe lines, minor and major losses, Darcy-Weisbach equation for major loss of head in pipes, Pipes in series and parallel, Transmission of energy through pipes, Introduction to computer aided analysis of pipe networks.

Uniform Flow in Open Channels:
Chezy's and Manning's equations, Bazin's and Kutter's equation. Most economical sections for rectangular and trapezoidal channels.

CT-109   **<u>SURVEYING</u>**

Aims

i-   To develop an understanding of surveying & leveling theory and practice.

ii-   To develop an ability to translate survey information for design and construction purposes.

iii-   To develop a skill in the use of survey instruments.

Description:

The course provides an overview of surveying & leveling practice and demonstrates an understanding of area control by theodolite and compass. It explains the methods of establishing the contours of an area by field exercise. It includes exercises in setting out and controlling complex construction works.

Contents:

1. **Survey Instruments:** Study and use of conventional surveying instruments and EDM devices.

(1 Weeks)

2.   **Triangulation and Traversing:** Station selection, base line measurement, computations, adjustment, plotting and detailing of triangulation/trilateration schemes, Total station, GPS.

(3 Weeks)

3.   **Leveling:** Ordinary level leveling, precise leveling, profile leveling. Errors and correction in leveling, plotting longitudinal and cross-section of leveling. Trignometerical leveling and contouring.

(3 Weeks)

4.   **Techeometry:** System of techeometry, applications of techeometer in surveying, computation.

(2 Weeks)

5. **Setting Out Works:** Setting out curves (horizontal, vertical, transition), demarcation of buildings and bridges, sewer lines, route lines, tunnels etc.

(3 Weeks)

6.   **Hydrographic Surveying:** Introduction to hydrographic surveying, sounding methods.

(2 Weeks)

7. **Astronomy:** Fixation of true north, latitude, longitude and time.

(1 Weeks)

Practical:

1- Study and use of conventional instruments & EDM surveying instruments [3].
2- Check and adjustment of level and theodolite [2].
3- Contouring and contour plotting [5].
4- Theodolite traversing [4].
5- Profile and precise leveling [5].
6- Triangulation and traversing [5].
7 - Computation adjustment and plotting of transportation scheme [3].
8- Data monitoring of true north [2].

Textbooks:

1. Surveying Theory and Practice by R. E. Davis, J. Anderson, F.S. Foote, McGraw Hill (Latest Edition).

Reference Books:

1. Surveying by Jack C. McCormac (Latest Edition).
2. Schaum's Ouline Series of Introductory Surveying by R. H. Wirshing, Roy Wirshing, Jaews R. Wirshing (Latest Edition).0
3. Surveying with Construction Applications by Barry F. Kavanagh, Prentice Hall (Latest Edition).
4. Plane and Geodesic Survey Vol. I and II by David Clarck, Trans-Atlantic Publications (Latest Edition).

CTIS-110   ISLAMIC AND PAK STUDIES/ETHICS

(Course offered by Islamic/Humanities Department)

CT-111   TECHNICAL DRAWING

Objectives:

1) Introduction to the subject and drawing equipment.

2) Lettering and dimensioning, graphic symbols, free hand sketches and isometric views. Method of sections including assembly sections.

3) Orthographic projection, orthogonal projections of simple solids in simple position, oblique and auxiliary planes.

4) Isometric and pictorial projections of solid figures, making of free hand sketches from solid objects and from orthographic projections. Intersection of surfaces. Development of surfaces.

5) Introduction to Civil Engineering drawing, preparation on of plan, elevation and sections for simple buildings. Introduction to Computer Graphics.

6) Types of Civil Engineering drawing. Preparation of plans, elevations and sections. Working drawings of a residential building. Computer graphics.

7) Application of architectural planning and rendering in Civil Engineering projects using computer aided drawing.

CT-112 PRACTICAL FIELD TRAINING & REPORT SUBMISSION-1

(Students will be assigned practical jobs at the end of which report will be submitted)

3rd SEMESTER

CTMA-201 STATISTICS AND NUMERICAL METHODS

(Course number to be assigned by Mathematics Department)

Statistics: Frequency distribution, histogram, polygon, ogive. Measures of dispersion; Mean, mode, median, standard deviation, variance, characteristics strength. Correlation, rank correlation, Lines of regression. Least square method. Probability. Theorems of addition and multiplication.

Solution of Non-linear Equations: Simple iteration. Bisection method, Newton's method, secant method, method of false position, comparison of these methods.

Finite Differences: Difference operations and tables, differences of polynomials, Newton's and Gauss interpolating techniques for equally spaced data, simple theorems on divided differences, Newton's formulation for unequal intervals, Lagrange's formulation of interpolation, curve fittings by the method of least squares.

Numerical differentiation and integration with civil engineering applications.

Solution of Linear Simultaneous Equations: Gauss elimination method, Jacobi's method. Gauss-Siedel method, sparse matrices, solution of ordinary differential equations, initial value problems, Euler and modified Euler methods, Runge-Kutta and Kutta-Merson methods.

Eigen-values and Eigen-vectors: Interactive and transformation methods, eigen-values of tri-diagonal matrix.

Solution of Polynomial Equations: Polynomial arithmetic, finding initial approximations and complete solution of polynomial regression analysis.

CTHU-202   <u>**COMMUNICATION SKILLS-II**</u>

Aims

1. To understand the environment of professional communication.
2. To learn the use of technology in communication.
3. To enhance the presentation skills.
4. To improve the writing skills in a professional environment.

Description

This course is based upon lectures, group discussions, case studies and practice sessions.

Contents

1   Communication and Technology   4 weeks
   - Presentation Graphics and Word Processing
   - Fax, Email, Internet and Voice Mail
   - MS Power Point and Use of Multimedia
   - Teleconferencing
   - Audio Visual Aids

2   Presentation Skills   4 weeks

   - Defining Objective
   - Audience Analysis
   - Style and Tone
   - Credibility
   - Opening, Closing and Main Ideas

   - Use of Audio Visual Aids

3 Meetings and Interviews   3 weeks
   - Participating in Meetings
   - Chairing a Meeting
   - Asking and Answering Questions in Meetings
   - Preparing Resumes
   - Preparing for Interviews
   - Asking and Answering Questions in Interviews

4   Letters and Memos   2 weeks
    - Formats
    - Positive and Negative Messages
    - Persuasive Communication
    - Requests

5   Technical Report Writing   2 weeks
    - Introduction and Importance
    - General Formats
    - Short and Long Reports
    - Proposals
    - Quoting References

Text Book

1. Murphy H. A., Hildebrandt H. W. and' Thomas J.P. EFFECTIVE BUSINESS COMMUNICATIONS. McGraw-Hili, USA (Latest Edition).

Reference Books

1. Morrisey G. L., Sechrest T. L. and Warman W. B. LOUD AND CLEAR. Addison-Wesley Publishing Company, USA (Latest Edition).
2. Beebe S. A. and Beebe S. J. PUBLIC SPEAKING. Allyn and Bacon, USA (Latest Edition).

CT-203   SURVEYING AND APPLICATION OF GIS IN CIVIL TECHNOLOGY

Theory:

Introduction: Introduction to advanced surveying and its application,

Triangulation, trilateration, field procedures and application, EDM, strength of figure, computation and plotting.

Theory of errors and Weights: quality of observations, weighted observations, distribution and adjustment of errors. Most probable value.

Curves: Various types of curves with application: simple circular curve, compound curves, transition curves, vertical curve and reverse curves, Design and layout of curves.

Tunnel surveying: Use of gyroscope.

Hydrographic surveying: Horizontal and vertical controls, submarine surface contours. Discharge measurement, reservoir capacity calculation.

Field astronomy: Solar and stellar observations for position and azimuth determination.

Photogrammetry: Introduction, definition and application of aerial and terrestrial photogrammetry.

Remote sensing/satellite imagery and its applications: Introduction & applications of remote sensing in Surveying, Types of remote sensing, sensors and platforms used for remote sensing.

Use of stereoscopy and GPS.

GIS: Introduction & applications of GIS in surveying, digitizing and topographic mapping using GIS software.

Field/Lab. Work:
Base line measurement, curve layout (simple circular curve, reverse curve, composite curve, vertical curve), computation and plotting, field astronomy, total station/gyro station, GPS based survey, integration of GPS data in GIS software, creation of contour sheet using GIS.

CT-204   CONCRETE TECHNOLOGY-I

Objectives:

i)   To develop an understanding of the composition and behavior of plain and reinforced concrete.

ii)   To understand various methods of proportioning of constituent materials for a required concrete quality.

iii)   To analyze the problems of transportation, pouring, bleeding of concrete.

iv)   To understand methods of curing and compaction and factors affecting strength of concrete.

v)   To know the benefits of testing of concrete and to understand the procedure of quality control.

vi)   To get introduction of the design of simple beams for flexure and shear.

Description

This subject contains the properties and behavior of plain and reinforced concrete, the design of concrete mix and the factors affecting it. The basic reinforced 'Concrete design

and placement of reinforcement in structures are explained. Construction details are also presented related with the design.

Contents

1. **Concrete Properties and Its Behavior:** Properties of aggregates, cement and concrete, properties of fresh and hardened concrete, strength, elastic behavior, shrinkage and creep and durability to chemical and physical attacks. Methods of testing concrete cylinders and cubes in compression. Effects of impurities in water and in aggregates on the performance and durability of plain and reinforced concrete. Effect of water/cement ratio upon workability and strength of concrete.

    (4 Weeks)

2. **Mix Design:** Requirements of cube cylinder strength, workability and aggregate size. Prescribed mix, design mix and the effect of varying proportions of the component parts. Procedure for design of concrete mix (ACI, British Standard Specifications and Road Note No.4). Laboratory and site testing for assessing the quality, performance and strength of a design mix.

    (3 Weeks)

3. **Reinforced Concrete:** Mechanics of reinforced concrete and its behavior under working and ultimate loads. Basics of reinforced concrete design. Analysis and design of RC beams and columns for flexure, shear, axial load, and anchorage by ultimate strength design method. Design for diagonal tension and bond. Behavior of one-way and two-way slabs and their design.

    (5 Weeks)

4. **Detailing and Fabrication of Reinforcement:** Function of reinforcement in structural concrete elements with respect to resisting tension, compression, shear and shrinkage cracking. Concrete cover to reinforcing bars and its variation in different structural elements, lapping of reinforcement, details of bar bending and preparation of schedules. Preparation of working drawings of structural elements. Introduction to different types of concrete foundations.

    (3 Weeks)

Practical

1. Organic impurities and water absorption of aggregates [2].
2. Determination of specific gravity and bulk densities of aggregates, aggregate gradations [2].
3. Casting specimens for varying w/c ratio and bulk densities, slump test and casting 6" cubes and cylinders [4].
4. Effect of w/c ratio on strength of concrete (compressive strength test on cubes and cylinders as (3) above [4].
5. Preparing test specimens from hand mixed, machine mixed and hand compacted

concrete [2].

6. Compression tests on specimens as (5) above and making comparisons [2].
7. Determination of initial and final setting time for Portland cement [2].
8. Comparison of cube and cylinder strength [2].
9. Casting of beam specimens and testing specimen of 4", 6", 8" cubes and 6" cylinder [4].   .
10. Slump test on course & fine aggregates from different sources [4].
11. Modulus of rupture test on beam specimens [2].

Text Books

1. Properties of Concrete by A. M. Neville; Wiley John & Sons. (Latest Edition).
2. Concrete Design by Zahid Ahmad Siddiqi, Help Civil Engineering Publishers, Lahore, 2009.

Reference Books

1- Design of Concrete Structures by H. Nilson, McGraw Hill. (Latest Edition).
2- Reinforced Concrete - Design & Behavior by C. K. Wang & Salmon.
3- Elementary Reinforced concrete by W. Morgan (Latest Edition).
4- R.C. Designers Handbooks by Charles. E. Raynold; Chapman & Hall. (Latest Edition).

CT-205   STRUCTURAL MECHANICS

Objectives

- To develop the understanding of the behavior of determinate structures with reference to beams and frames.

- To provide the concept of statically indeterminate structures illustrating their application to structures like beams, trusses and rigid frames.

- To understand the behavior of arches and suspension cables.

Description

The contents of this course are organized to have a clear understanding of the stability and determinacy of structures. The principles of strain energy and Castigliano's theorem for determination of elastic deformations are explained. It introduces basic understanding of conventional methods of analysis for indeterminate structures. Background of the matrix methods of analyses is also included.

Contents

1. **Stability and Determinacy of Structures:** Equation of equilibrium, support

reactions and concept of free body diagram at a cut section of a structure. Static stability and determinacy of structures and degree of indeterminacy of rigid frames and pin jointed structures. Analysis of determinate beams, trusses and frames.

(3 Weeks)

2. **Elastic Deformation of Structures:** Principles of strain energy, virtual work and Castigliano's Theorems for determination of elastic deformations in structures.

(3 Weeks)

3. **Influence Line Diagram:** Concept of influence line diagrams for statically determinate structures and its application to simple structures to calculate maximum shear force and bending moments for moving loads. Influence line diagram for different members of framed structures.

(3 Weeks)

4. **Analysis of Statically Indeterminate Structures:** Method of Consistent deformations and its application to indeterminate beams, rigid frames and trusses.

Method of Least Work: Method of least work and its application for the analysis of indeterminate beams.

Moment Distribution Method: Moment Distribution Method and its application with sway and without sway to indeterminate beams and frames. Axial force, shear and bending moment diagrams along with the deflected shape of the structures.

Slope Deflection Method: Slope deflection method for analysis of beams and rigid frames.

(4 Weeks)

5. **Introduction to Analysis by Computer:** Matrix methods and its computer application in structural analysis.

(2 Weeks)

6. **Arches, Suspension and Cable Bridges:** Analysis of three hinged arches, behavior of suspended cables, and introduction to suspension bridges.

(2 Weeks)

Practical

a) Plotting Maxwell's diagram. Background, theory & instruction [2], experiment [2], discussion and reports [2].
b) Performing experiments on frame model for deflections and internal forces. Background, theory & instruction [3], experiment [2J, discussion and reports [2].
c) Solution of typical frames by numerical and graphical methods. [4].
d) Drawing B. M. and S. F. Diagrams for moving loads [5].

e) Practical examples in drawing of influence lines [5].

f) Solution of some problems regarding struts [3].

Text Books

1.   Statically Indeterminate Structures by C. K. Wang, McGraw Hill (Latest Edition).

Reference Books

1.   Elementary Theory of Structures by Yuan-Yu Hsieh. Prentice Hall, Inc. (Latest Edition).
2.   Theory of Structures by Timoshenko. McGraw Hill (Latest Edition).
3.   Structural Analysis by H. I. Laursen; McGraw Hill (Latest Edition).
4.   Theory of Structures by J. C. McCormac. Harper & Colins Publishers (Latest Edition).

4th SEMESTER

CT-206   **SOIL MECHANICS**

Significance. Soil, rock and their types and formation. Physical properties of soil: water content, voids ratio, porosity, degree of saturation, specific gravity, unit weight and their determination, mass-volume relationships.

Soil Classification: Importance of classification tests. Atterberg's limits, grain size distribution; Classification systems.

Permeability and Seepage: Darcy's law, factors affecting permeability, laboratory and field determination of permeability. Seepage force, estimation of seepage quantity, quick sand condition, sand boiling and filters.

Compaction: Fundamentals, moisture density relationship, compaction standards, factors affecting compaction, field control and measurements of insitu density. Field compaction equipments.

Stress Distribution in Soils: types of soil stresses, stress induced due to structural loads: Westergaurd and Boussinesq's theories for stress evaluation. Pressure bulb, Stress distribution diagrams, Fadum Charts.

Consolidation: Mechanics of consolidation, Oedometer test and data interpretation, primary and secondary consolidation. Normally and pre-consolidated soils.

Shear Strength: Concept, parameters, Coulomb's law, shear strength of cohesive and non-cohesive soils. Factors affecting shear strength of soil and its applications in engineering. Laboratory and field tests for determination of shear strength.

Earth Pressures: Definition, pressure at rest, active and passive earth pressures. Coulomb's and Rankine's theories. Earth pressure problems.

Slope Stability: Types of slopes, Factors affecting stability and remedies. Types of failure Methods of analysis.

Earth and Rock Fill Dams: Introduction, types of earth and rock fill dams and their components, general design considerations and typical cross-sections.

CT-207   <u>HYDRAULIC MACHINERY</u>

Forces on Immersed Bodies: Development of boundary layer on immersed bodies, elementary theory of surface drag and form drag, simple lift and drag equations and their applications to simple engineering problems, separation of boundary layer.

Impact of jets: Impulse momentum equation and its application, forces on stationary and moving flat and curved vanes. Force on reducer and reducer bend.

Impulse Turbine: Introduction, types of Impulse turbines, Pelton Wheel and Turgo Turbine; their main components and functions, work done by the Pelton wheel, specific speed.

Reaction Turbine: Introduction, types, Francis reaction turbine and Kaplan turbine, main components and their functions. Cavitation and Pitting. Governing of turbines. Similarity laws and factors for turbo machines.

Pumps: Introduction and types of pumps.

Centrifugal pump: classification, main components and their functions. Work done by the Centrifugal Pump. Maximum suction lift of the pump, Specific Speed, Shut-off head and Normal discharge of the pump.

Reciprocating pump: Introduction, types, single and double acting pinups, indicator diagram, acceleration head, maximum suction head and use of air vessels.

CTEN-208   <u>WATER SUPPLY AND WASTE WATER MANAGEMENT</u>

Objectives

i-   To introduce basic concepts relating to the provisions of water supply and

wastewater collection facilities.

ii-   To enable students to design water supply and wastewater collection systems.

Description

This course deals with the application of scientific and engineering principles in water supply and wastewater collection. In this course the students will learn about collecting necessary data on water and wastewater quantities and utilize the collected data in the design of water distribution and sewer systems. The course also covers the topics on construction of water supply and wastewater collection systems.

Contents

1.   **Introduction:** Water supply and wastewater collection systems and their importance with respect to human health. Water borne diseases. Types of impurities and their affects on human health standards, WHO standards.

(1 Weeks)

2.   **Estimation of Water Demand:** Water consumption. Components of water consumption. Factors affecting consumption. Fire demand. Variations in demand: average daily consumption maximum daily consumption and peak hourly consumption. Commonly used values of water consumption. Local design guidelines. Design period: factors affecting design period. Commonly used design period and local criteria. Population forecasting: mathematical and graphical methods of forecasting population. Population density.

(3 Weeks)

3.   **Source of Water:** Ground and surface source. Selection of water sources with respect to quantity and quality considerations.

(1 Weeks)

4.   **Collection and Distribution of Water:** Intake structure: reservoir, river and canal intakes. Methods of water distribution. Components and layout of water distribution system. Storage capacity of overhead reservoirs. Use of Hazen William formula for the design of water distributions systems. Hardy Cross method. Use of microcomputers in design. Types of pipes and their use in water distribution. Pipe joints, service connection. Valves and fire hydrants. Construction of water distribution systems. Disinfections of old and new pipes. Water waste surveys and tracing of leakages. Pipes in series and parallel, heard losses, major losses minor losses.

(4 Weeks)

5.   **Estimation of Wastewater Quantities:** General considerations. Classification of sewage and sewer systems. Combined and separate sewer systems. Estimation of sanitary sewage quantities. Estimation of storm flow: the rational method, runoff coefficients, Intensity-Duration Frequency relationships.

6. **Design of Sewer Systems:** Layout of sewers. Sewer appurtenances: manholes, drop-manholes and storm water inlets. Design criteria for sanitary and storm sewers. Self cleansing velocity. Use of Manning's Equation for the design of sanitary and storm sewers. Construction of sewers: types of beddings, joints and laying of sewers. Sewer testing. Sewer cleaning equipment.

(4 Weeks)

Practical

1- Forecasting population of various cities using different methods. (6 hrs)
2- Detailed study of different types of valves. (6 hrs)
3- Detailed study of different pipe material and joints for water supply and sewerage. (6 hrs)
   · Report evaluation. (3 hrs)
4- Design of a transmission main. (6 hrs)
5- Design of water distribution system for a housing scheme. (12 hrs)
   · Report evaluation. (3 hrs)
6- Design of a sanitary sewer system. (12 hrs)
7- Design of storm sewer system. (12 hrs)
   · Report evaluation. (3 hrs)
8- Preparation of drawings for different bedding of sewers. (9 hrs)
9- Preparation of working drawings for manholes, drop manholes and storm water inlets. (9 hrs)
   · Report evaluation. (3 hrs)

Text Book

1. Water Supply and Sewerage by E. W. Steel and L. J. McGhee. McGraw Hill, New York. 1979 (Latest Edition).

Reference Books

1- Water and Wastewater Technology by M. J. Hammer, John Wiley & Sons. New York, 1986 (Latest Edition).
2- Wastewater Engineering: Collection and Pumping of Wastewater by Metcalf and Eddy. McGraw Hill, New York, 1981 (Latest Edition).

CT-209   QUANTITY SURVEYING AND CONTRACT DOCUMENTS

Obiectives

i) To develop ability to measure construction works in an orderly manner.

ii) To develop a systematic approach of cost estimation of a construction job.

iii) To develop an understanding of preparing of contract documents and managing / execution of civil engineering works.

Description

The course starts with a brief review of the diploma course and extends the knowledge of a systematic approach for cost estimation, understanding of preparing of contract documents and tendering of works. The use of computer spreadsheets in estimation is also introduced.

Contents

1. **Earth Work Quantities:** Working out earthwork quantities for various civil engineering constructions. Calculating quantities for road embankments in plain and hilly areas and for irrigation channels.

   (2 Weeks)

2. **Rate Analysis:** Scheduled and non-scheduled rates. Analysis of rates, abstract of costs. Significance of rate analysis and its application to market rates of material and labor. Rate analysis for various items of civil engineering works.

   (3 Weeks)

3. **Cost Estimates:** Systematic and logical approach to the estimating and costing of civil engineering works, rough cost & detailed estimates, bill of quantities and part bills for construction, costs and profit margins to be considered in the cost estimates. Estimates for roads, buildings, reservoirs, water supply, drainage projects, steel works and bridge construction. Estimates using computer spreadsheets.

   (4 Weeks)

4. **Contract Documents:** Introduction to work contracts and tendering. Types of contracts. Requirements of a specific contract, drawings necessary for a contract and those required during the execution of work. Tender documents, construction specifications, bill of quantities and other setting out data required for a contract. Time scheduling of different construction activities for the execution of the projects. General conditions of contract and special conditions of contract. Safety and control aspects required in the execution of the contract.

   (4 Weeks)

5. Use of Computer Spreadsheets in making bill of quantities (BOQ).   (1 Weeks)

6. Labour output, incentives and laws.   (1 Weeks)

Practical

1- Preparation of bill of quantities, abstract of cost, rate analysis of buildings of different types, exercise on road construction and culverts/bridges [16].

2-   Writing specification for all items of works in respect of anyone of the above exercises [14].

Text Books

1.   Estimating Construction Costs by R. L. Peurifoy. McGraw Hill. (Latest Edition).

Reference Books

1-   Contract Specifications by Daniel and W. Mead (Latest Edition).
2-   Construction Scheduling, Cost Optimization and Management by H. Adeli and A. Karim. (Latest Edition).
3-   MES/Pak PWD Schedule of Rates (Latest Edition).
4-   WAPDA Drafting Standards (Latest Edition).

CTIS-210   **ISLAMIC AND PAK STUDIES/ETHICS**

(Course offered by Islamic/Humanities Department)

CTIS-211   **PRACTICAL FIELD TRAINING & REPORT SUBMISSION-II**

(Students will be assigned practical jobs at the end of which report will be submitted)

5th SEMESTER

CT-301   **SOIL INVESTIGATIONS**

Introduction: purpose and significance, factors affecting soil investigation, structure of soil investigation, sources of information.

Planning and Management: Number of investigation points, their locations and depth of exploration, time frame and suitable method of investigation.

Phases of soil investigation: desk study, site reconnaissance, preliminary investigations, detailed investigations, post construction investigations.

Methods of investigation: shallow and deep exploration, test pits and trenches, probing, auger and percussion boring, rotary drilling, core drilling.

In-situ testing: field density tests, SPT test, CPT test, pressure meter test, dilatometer testing, permeability testing in soil and rock,

Ground water table monitoring: effects of ground water table fluctuations, various methods to establish ground water table.

Soil Sampling: types of soil sample, causes of sample disturbance, types of soil samplers, methods of sampling.

Data interpretation and report writing: evaluation of field and laboratory data, boring log, bearing capacity analysis, recommendations for foundation design and construction.

CT-302   **HYDROLOGY**

Introduction:
Hydrology, hydrological cycle and the hydrological equation, practical uses of hydrology, importance of hydrology.

Meteorology:
The atmosphere and its composition, relative humidity, dew point and their measurement devices, Saturation deficit, Solar radiations as a source of heat, adiabatic changes and the laps rate, air temperature, seasonal and diurnal variation of air temperature, The general circulation of wind system, the monsoon and western disturbances, Measurement of air temperature, relative humidity, radiation, sunshine and atmospheric pressure.

Precipitation:
Type of precipitation, factors necessary for the formation of precipitation, measurement of precipitation, interpretation of precipitation data.

Evaporation and Transpiration:
Factors affecting evaporation, measurement of evaporation, evapo-transpiration.

Stream flow:
Water stage and its measurement, selection of site for stage record, selection of control and metering section, methods of measurement of stream flow, interpretation of stream flow data.

Runoff: Factors affecting runoff, estimating the volume of storm runoff.

Hydrograph:
Characteristics of hydrograph, components of hydrograph, hydrograph separation, estimating the volume of direct runoff, introduction to unit hydrograph concept, S-curve.

Floods and their estimates:
Introduction to floods, causes of floods, methods for the estimation of floods, flood estimation from past flood marks, Rational formula, empirical formulae, using unit hydrograph method and flood frequency analysis.

Ground Water Flow:

Introduction, sources and discharge of ground water. Water table and artesian aquifer. The Thiem and Theis formula and its application to aquifer tests.

CT-303   **BRIDGE TECHNOLOGY**

Aims:

      1). To develop an understanding of an integrated approach to the structural design of

        Bridges.

      2). To present latest design concept of steel and concrete bridges.

Description:

Latest design concepts of steel and concrete bridges are presented. The course includes bridge loading, AASHTO standard decks and type of foundation required under different site conditions. Construction details, repair, inspection and rehabilitation of bridges are also explained.

Content:

1. **Introduction:** Bridge development, selection of type of bridge. Material for bridge construction, types of bridges, skew of bridges, movable bridges, suspension bridges, cable stayed bridges, box girder bridges, cantilevered penetration bridge.   **4 weeks**

2. **Hydraulics:**   Data of stream crossing the bridge, free board, depth of sour, Lacey,s formula for scour. Foundations and its types.   **4 weeks**

3. **Bridge Loading:**   Dead load, live load , wind force, longitudinal forces, centrifugal force, earthquake loads , tractive forces, load combination. Width of road, kerbs, traffic lines, value of moment , per traffic line. AASHTO, NLC and army loading. Railway loading.
         6 week

4. **Construction:** AASHTO standard types of decks, width of road way, kerbs, footways. Floor of girder bridges, T- beam bridges, Orthotropic briudge, arc bridge, through bridge, bridge bracing in steel , constructions, slip from construction, support details. Hinged & roller supports , expansion support.
         8Weeks

5. **Foundation:** Bearings, piers and abutments. Expansions joints and other practical dateails.   **2 Weeks**

5. **Bridges Rating:** Design codes. Allowable stresses, recommended values for structural steel, reinforcing steel, concrete, pre-stressed concrete and other materials. Bridges inspection, maintenance and rehabilitation
    6 Weeks

    Practical:
    1. Working drawing for concrete and prestressed concrete bridges. (6)
    2. Working drawing for steel bridges.(5)
    3. Drawing of culverts & causeways.(4)
    4. Drawing of bridges connection and foundation.(4)
    5. Estimation for bridges.(5)
    6. Site investigation of an actual field example and making necessary measuring for the site plane, making a road plane form the site.(3)
    7. Drawing of Railway Bridge.(3)

CT-304   <u>**CONCRETE TECHNOLOGY-II**</u>

Objectives:

i)   To develop an understanding of the long and short-term behavior of concrete.
ii) To develop an ability of design and preparing working drawings of concrete constructions.

Description:

This course presents a review of properties of concrete and systematic approach of design of RC structures. Detailing of reinforcement and preparation of working drawings of various types of structures are covered in detail using manual method and AutoCAD. Inspection, testing, repair and maintenance of concrete structures are also included.

Contents:

1. **Properties of Concrete:** Review of properties of aggregate, cement and concrete. Field practices and quality control, temperature, shrinkage, creep and fatigue, modulus of rupture, light weight and normal weight concrete, additives and admixtures, durability and workability of concrete, underwater concreting, prefabrication of concrete.

                                                                          (3 Weeks)

2. **Testing of Structures:** Non-destructive testing of concrete structures, defects in concrete structures and their repair. Inspection, maintenance and rehabilitation of

structures.

<div align="right">(2 Weeks)</div>

3. **Expansion Joints:** Preparation of structural layouts, estimation of trial member sizes, provision of expansion and contraction joints, work joints, water stopper joints.

<div align="right">(2 Weeks)</div>

4. **Reinforced Concrete Structure:** Design of continuous beams and slabs, columns and footings, retain
<div align="right">(4 Weeks)</div>

5. **Eccentrically Loaded Columns:** Column interaction curves and design of eccentrically loaded columns.

<div align="right">(1 Weeks)</div>

6. **Reinforcement Details:** Preparation of working drawings of reinforcement in beams, slabs, columns and footings using manual drafting and by AutoCAD. Preparation of bar bending schedule.

<div align="right">(3 Weeks)</div>

Practical:

1- Testing workability of concrete by (a) slump test (b) compacting factor test. Background, theory & instruction [4], experiments [2], discussion and reports [4].
2- Testing concrete cubes and cylinders. Background, theory & instruction [3], experiments [2], discussion and reports [3].
3- Mix design and its preparation. Background, theory & instruction [2], experiments [1], discussion and reports [2].
4- Design examples on beams, slabs, footings tanks and staircases [4].
5- To perform non-destruction test on concrete structures by Schmith hammer [3].

Text Books:

1. Concrete Design by Zahid Ahmad Siddiqi, Help Civil Engineering Publisher, Lahore, 2009.
2. Properties of Concrete by A. M. Neville; Wiley John & Sons. (Latest Edition).

Reference Books:

1. R.C. Designers Handbooks by Charles. E. Raynold; Chapman & Hall.
2. Reinforced Concrete by J-Faber and F. Meed; Chapman & Hall.
3. Reinforced Concrete - Design & Behavior by C. K. Wang & Salmon.
4. Design of Concrete Structures by H. Nilson, McGraw Hill.

CT-305   **ENGINEERING ECONOMICS**

Objectives:

i-   To understand value and cost concepts

ii-   To acquire the knowledge and skills related to the application of time value for money

iii-   To acquire the knowledge and skills related to the application of costing, financing and risk

iv-   To acquire the knowledge and skills related to the application of depreciation, obsolescence and replacement factors.

Description:

This is a management-oriented course with a significant involvement of calculations to find solutions to financial problems.

Contents:

1. Value and Cost Concepts   (2 Weeks)
   - Terminology
   - The General Economic Environment
   - Cost Driven Design Optimization

2. Time Value for Money   (4 Weeks)
   - The Concept of Equivalence
   - Present Value
   - Future Value
   - Uniform series
   - Discounted Cash Flow

3. Applications of Money-Time Relationships   (1 Weeks)

4. Cost/Benefit Ratio   (1 Weeks)

5. Depreciation and Obsolescence   (1 Weeks)

6. Costing   (3 Weeks)
   - Cost Factors
   - Product Cost and Selling Price
   - Project Cash Flows

- Absorption Costing
- Marginal Costing
- Breakeven Analysis

7. Replacement Analysis (1 Weeks)
   - Factors to be considered
   - Economic Life of Asset
   - Comparison and Replacement

8. Risk Analysis (1 Weeks)
   - Sources of Uncertainty
   - Sensitivity Analysis
   - Optimistic-Pessimistic Estimates Risk Adjustment

9. Capital Financing (1 Weeks)
   - Financing with Debt Capital
   - Financing with Equity Capital · Leasing
   - Capital Allocation

Text Book:

1. DeGarmo E. P., Sullivan W. G., Bontadelli J. A. and Wicks E. M. ENGINEERING ECONOMY. Prentice-Hall International, Inc., USA

Reference Books:

1. Morris C. QUANTITATIVE APPROACHES IN BUSINESS STUDIES. Pitman Publishing, UK (Latest Edition).
2. Tung A. and Thomas P. A. ENGINEERING ECONOMICS FOR CAPITAL INVESTMENT ANALYSIS. Prentice-Hall. UK (Latest Edition).
3. Horne J. C. V. and Wachowicz, Jr. J. M. FUNDAMENTALS OF FINANCIAL MANAGEMENT. Prentice-Hall International, Inc., USA (Latest Edition).

6th SEMESTER

CTEN-306   **ENVIRONMENTAL MANAGEMENT**

Contents:

1. Introduction to solid waste, classification of solid waste. Collection methods, transfer and transportation of solid waste, type of equipment, recycling, reuse and disposal of solid waste.
2. Air pollution: Introduction to air pollution, sources of air pollution, its   effects,

classification and control.
3. Introduction to EIA functions of Environmental Pollution Council, role of provincial EPAs, Environmental Protection Act, 1977, National Environmental Quality Standards.
4. Introduction to noise pollution and its mitigation measures.
5. Environmental health and safety.

Books:

1.   Introduction to Environmental Engineering by Peavy (McGraw Hill).
2.   Environmental Engineering by Mckenze (McGraw Hill).

Laboratory:

1.   Composition of solid waste (percentage)
2.   Energy Value.
3.   Moisture content.
4.   Nox and Sox by hand meters.
5.   Carbon monoxide by hand meters.
6.   Particulate matter.

Reference Books:

1.   Environmental Profile of Pakistan by IUCN. National Conservation Strategy by IUCN. ILO laws regulations

CT-307   <u>PROJECT MANAGEMENT</u>

Objectives:
i-   To learn the basic concepts of management.
ii-   To understand the importance of productivity and related concepts.
iii- Introduction to project management and inventory management.
iv-   Familiarization with human resource management.

Description:

This is a management-oriented course for technologists. It will enhance their general abilities of management, required in a technical environment.

Contents

1   Introduction   1 weeks
    •   Management: Science or Art
    •   History of Managements

- Management Functions

2   Organizational Structure   2 weeks
- Types of Organizations
- Organizational Hierarchy
- Properties of Narrow and Wide Organizations

3   Production Processes   2 weeks
- Types of Production
- Scale of Production
- Selection of Technology
- Input Requirements
- Capacity Utilization

4   Productivity   2 weeks

- Basic Concepts
- Classification
- Quantitative Measurement
- Productivity Improvement

5   Project Management   3 weeks

- Properties of Projects
- Project Life Cycle
- Project Network Analysis
- Resource Requirements
- Monitoring and Control
- Use of Computer

6   Inventory Management   2 weeks
- Inventory Replenishment
- Economic Lot Size
- Re-order Point
- Safety Stock Level
- JIT
- Use of Computer

7   Human Resource Management   3 weeks

- Management Styles
- Psychological Types
- Recruitment and Training
- Job Evaluation
- Performance Appraisal
- Motivation and Incentives

Text Books:

1. Babcock D. L. MANAGING ENGINEERING AND TECHNOLOGY. Prentice Hall, UK (latest Edition).
2. Zuberi M. H. INDUSTRIAL MANAGEMENT. Rabbani Printing Press, Lahore (latest Edition).

Reference Books:

1. Bateman T. S. and Snell S. A. MANAGEMENT: BUILDING COMPETITIVE ADVANTAGE. Times Mirror Higher Education Group, USA (latest Edition).
2. Spinner M. ELEMENTS OF PROJECT MANAGEMENT. Prentice Hall, UK (Latest Edition).

CT-308   **STEEL STRUCTURES**

Objectives:

i)   To develop an understanding of the behavior and design of structural steel members and connections using load and resistances factor design approach.

ii) To develop an understanding of the behavior and characteristics of structural steel systems.

Description:

The course is intended to provide an introduction to specification and code of practice for steel design and construction with special reference to Load and Resistance Factor Design (LRFD) for the design of various types of structural elements. It further introduces the methods of fabrication, construction details, maintenance of steel structure and rehabilitation.

Contents:

1. **Specifications And Code of Practice:** Structural steels, design loads, safety factors. AISC specification and code of practice. Concept of the design of steel structures with Load and Resistance Factor Design (LRFD). Design approach, design of members in tension, compression and flexure. Fabrication and erection of steel construction in accordance with current code of practice.

   (3 Weeks)

2. **Structural Steel Work:** Analysis and design calculation for a roof truss with purlins at and between node points. Design of purlin of angle, channel and W-section and use of sag rods in its design. Single and double angle struts for combined effect of axial force and local moment in main chord of the truss. Use of tables for selecting single and double angle struts and ties. Working drawings of the truss from the design data.

   (3 Weeks)

3. **Columns & Beam Column:** Behavior and design of axially loaded columns and columns in framed structure.

   (2 Weeks)

4. **Plate Girders:** Flexural design for an economical built-up section of a plate girder, introduction to design of intermediate stiffeners load bearing stiffeners. Drawings as per design.

   (2 Weeks)

5. **Connection, Splices and Base Plates:** Behavior of shear, rigid and semi-rigid connections. Design of riveted and welded building connections, behavior and design of rigid joints in frames, and brackets. Provision of splice plates. Design of base plates for hinged and roller ends.

   (2 Weeks)

6. **Crane Loading and Fabrication of Crane Girder:** Live loads, dead loads, impact factor, inertial loads, detailing requirements. Stability of cranes.

   (1 Weeks)

7. **Introduction to Bracing Systems:** Nodal bracing, diagonal bracing, bracing for trusses, design of bracing elements.

   (1 Weeks)

8. **Computer Methods:** Use of computer packages to find the forces and design of members in frames. Assignment of analysis and design of steel building including resistance to earthquake loads.

   (1 Weeks)

Practical:

1- Analysis, design and detailing of a roof truss. Analysis [3], design [5], detailing [4].

2-   Plate girder design and its detailed drawing. Analysis [2], design [4], detailing [4].
3-   Design of building connections and their detailing. Analysis [2], design [4], detailing [2].

Text Books:

1.   Steel Structures by Z. A. Siddiqi, and M. Ashraf, Civil Engineering Series Publishers, (Latest Edition).

Reference Books:

1.   LRFD Steel Design Aids by Z. A. Siddiqi, Help Civil Engineering Publishers, 2009.
2.   Structural Steel Design LRFD Method (Second Edition) by Jack C. McCormac; Harper Collins Publishers. ISBN: 0065016270. January 1994.
3.   Design of Steel Structures by E. H. Gaylord, C. N Gaylord; McGraw Hill. 1991.
4.   Steel Structures Design & Behavior by Charles G. Salmon and John E. Johnson.
5.   Structural Steel Designers Handbook by Fredrick S. Merritt.
6.   LRFD Steel Design by William T. Segui; PWS Publishers. ISBN: 053493353X. January 1993.
7.   Design in Structural Steel by John E. Lothers.

CT-309   RENEWABLE ENERGY RESOURCES

- Introduction to various energy resources.

- Hydropower Energy: introduction, potential resources, introduction to low head and high head hydropower plants, layout and sizing, design etc.

- Tidal Energy: General introduction, energy potential in Pakistan, site selection, wind energy estimation and simple design of wind turbine etc.

- Wave Energy: Introduction to wave energy, wave characteristics/types, energy potential, turbines selection, design etc.

- Bio- Energy: introduction, potential, resources investigation, design etc.

- Wind Energy: Introduction, wind energy potential, planning and design investigation etc etc.

- Solar and Geothermal Energies: General introduction, resources investigation, energy potential, resource development, design and investigation and other subject areas related to these energy types.

7th SEMESTER

CT-401   DISASTER MANAGEMENT

- Introduction to Disaster Management
- Impacts of Disasters
- Disaster Cycle: Preparation/Prediction, Mitigation, Response, Recovery.
- Natural and Man-made disasters.
- Institutional setup for disaster management in Pakistan.
- Introduction and management of various Disasters:
- Floods: Flood frequency, Flood protection Plans
- Droughts: Definition, Prediction, Mitigation
- Disaster related to Earthquake: Measuring earthquake sizes, Seismic movements, Sesmisity of Pakistan, Seismic hazard analysis, Building Codes
- Introduction to Wind-Storm, Explosions.

CT-402   TRANSPORTATION ENGINEERING

Aims:

    To develop an understanding of the fundamentals of highway geometry and to apply it in the design of Highways & Railways.

    To produce an ability to use the survey works in the development of layouts of Highways & Railways.

Description:

This course introduces the road standards and specifies geometric design of Highway elements. It provides recommendations for the layout of junctions and roundabouts. It introduces the computer programs for design and estimation of roads. The concepts introduced here are expanded in other courses.

Contents:

1. **Road Standards:** NHA, AASHTO and Road Note 31, recommendations for the design of roads regarding:

    i)   Design parameters.

    ii)   Cross-sectional elements of roads such as lane widths, shoulder widths, median widths, edge clearance, ROW (right of way) requirements, sight distances etc.

iii)   Road layout parameters.
iv)   Road camber gradient and super elevation.
v)   Vertical and horizontal alignment of road.

(2 Weeks)

2.   **Geometric Design:** Geometric aspects of highways, design of transportation facilities based on operational capacity, site constraints and safety considerations. Layout of circular, transition and vertical curves. Traffic surveys for design and improvement of roads.

(2 Weeks)

3.   **Intersections:** Factors influencing the layout of junctions and design of roundabouts, provision of junctions on single carriageway and dual carriageway sites. Parking spaces, underpasses, motorways, flyovers, motorway intersections. Widening of roads on curves.

(2 Weeks)

4.   **Road Drainage and Protection:** Surface and sub-surface road drainage, camber and grade for highways surface drainage and proper sub-grade for sub-surface drainage, drainage structures of the required capacity for cross drainage.

(2 Weeks)

5.   **Airports:** Factors affecting site selection and layout of airport with respect to geographical, aeronautical, political and economical conditions. Wheel loads of different aircrafts. Introduction to pavements and typical cross-sections. Introduction to layout of airport buildings.

(2 Weeks)

6.   **Railways:** Track structure, railway alignment & grades, cross section of railway tracks & their laying, points, crossing and level crossing.   Modern   method   of laying railway tracks. Railway organization in Pakistan.

(3 Weeks)

7.   **Estimation by Computer:** Use of computer programs for the design and estimations of a road project as an alternative to the manual methods/techniques.

(2 Weeks)

Practical:

1-   Drawing of roads and railway in cuttings and fillings [4J.
2-   Exercises in drawing layouts of intersections and roundabouts [4].
3-   Exercises to calculate the quantities of materials required for various types of pavements and various sections of highways [6].
4-   Drawing sheet showing plans and profile of a road [4].
5-   Drawing sheet showing general layout of airport buildings [3].
6-   Details of different rail fastenings [3].

7 -   Exercises for provision of containment, transition curves and re-alignments of curves [6].

Text Books:

1.   Highway Engineering by C. H. Oglesby, Russell G. Hicks. ISBN: 047102936X. John Willey & Sons. January 1982 (Latest Edition).

Reference Books:

1-   A Policy on Geometric Design of Highways & Streets AASHTO Staff, ISBN: 1560510013. January 1990 (Latest Edition).
2-   Hand Books of Highway Engineering by Baker (Latest Edition).
3-   Railways, Bridges and Tunnels by S. K. Sharma (Latest Edition).
4-   Roads, Railways, Bridges and Tunnels by Deshpande Antia and Shahna (Latest Edition).
5-   Highway Design Manual, Highway Department, Govt. of the Punjab (latest edition)

CT-403   WATER RESOURCES ENGINEERING

Course Contents:

- Introduction to Water resources Engineering
  (Hydraulic Engineering, Irrigation, River Engineering)
- Water Resources
  o Planning and development of water resources projects.
  o Water resources in Pakistan.
- Irrigation
  o Definition and types of irrigation.
  o Merits and demerits of irrigation
  o Indus basin irrigation system.
- Design of irrigation channels
  o Regime (Empirical) Methods for design of irrigation channels.
  o Semi Empirical Approaches
  o Rational methods for design of irrigation channels.
  o Comparison of various methods.
- Canal Irrigation
  o Elementary concept about canal head works
  o Selection of their site and layout
  o Weirs and barrages
  o Various components and functions.
- Dams
  o Types of Storage Dams.

- o Forces on Dams.
- o Design of Gravity Dams.
- o Reservoir Engineering.
- o Regulation of Storage Reservoirs.
- Hydro Power Engineering
Selection of Hydropower Sites.
Components and Layout of Waterpower Scheme.
- Steady Flow in Open Channels
  - o Specific Energy and Critical Depth.
  - o Surface Profiles and Back Water Curves in channels of uniform sections.
  - o Hydraulic Jump and its practical applications.
- Unsteady Flow
  - o Unsteady flow through Pipelines.
  - o Discharge through orifices and over weirs under varying heads
    Water Hammer.

CT-404   <u>**COMPUTER APPLICATION IN CIVIL TECHNOLOGY**</u>

1. An understanding of matrix algebra and stiffness method. A review of matrix algebra and understanding of matrix method of analysis e.g. stiffness method and finite element method.

2. To develop an ability to analyze and design structures by computer packages.

Description:

This course gives the required details of the matrix methods of structural analysis for different types of structures and loads. The use of commercial packages is explained for input, output, accuracy and reliability of results. Concepts of finite element method are also explained.

Contents:

1. **Matrix Operations:** Review of matrix operations, basic concepts of matrix structural analysis, stiffness equations, stiffness matrix, load vector, assembly of global stiffness matrix, solution of simultaneous equations. One-dimensional and two-dimensional formulations, local/global coordinate systems. Bandwidth, degree of freedom.

(4 Weeks)

2. **Loads:** Member loads, joint loads, uniformly distributed and triangular loads, introduction to dynamic loads.

(1 Weeks)

3. **Computer Storage and Handling:** Preparation of data files, graphical input of

data, interpretation of results, verification of results, accuracy of calculations. Computer storage and execution time requirements. Analysis of trusses and frames.

(2 Weeks)

4. **FEM:** Introduction to finite element method, shape function. Convergence of results. 3-D models with plates and shell elements.

(2 Weeks)

5. Support rotations and settlements. (1 Weeks)

6. Internal hinges, partial shear and moment releases, diaphragms, shear walls, rigid links.

(2 Weeks)

7. Non-prismatic members.

(1 Weeks)

8. Design of a simple steel frame.

(2 Weeks)

Practical:

1. Manual analysis of a simple truss by stiffness method, its data file preparation and solution by SAP-2000 [4].
2. Manual matrix formulations of a two span beam by stiffness method, its data file preparation and solution by SAP-2000 [4].
3. Use of graphical input facility to analyze a truss for different loading conditions [4].
4. Analysis of a 2-D frame with partial releases, etc [3].
5. Analysis of simple 3-D frame with slab modeled as plate element with rigid links between slab and beam centroids [4].
6. Analysis of response of a 2-D frame to earthquake excitation [4].
7. Design of a simple steel frame by SAP-2000 [3].
8. Observing convergence of results in a 3-D frame having plate elements of varying sizes. [3].
9. Introduction to SLIDE.
10. Introduction to HECRAS.
11. Introduction to HMS.

Text Book:

1- Finite Element Structural Analysis by T. Y. Yang, Prentice Hall Inc. Englewood Cliffs, (Latest Edition).

Reference Books:

1. Matrix Structural Analysis by Ronald L. Sack; Waweland Press. (Latest Edition).
2. A First Course in the Finite Element Method by William B. Bickford, IRWIN, Homewood, (Latest Edition).
3. Structure Analysis Programme (latest Version).

CTAR-405   INTRODUCTION TO ARCHITECTURE AND TOWN PLANNING

Aims:

To know about Architecture and Town Planning and their importance in civil engineering.

Contents:

1. Architecture

a)   General. Introduction to history of architecture. Emergence and development of Islamic Architecture. Geographical, climatic, religious, social, historical aspects of architecture. Truth, purpose and beauty. Strength, vitality, grace, breadth and scale. Proportion, colour and balance. Acoustics.

Forms and Molds. Introduction to architectural standards, public toilets, circulation areas, parking, public assembly. Local architecture, arches, cavity walls, local energy efficient materials. Thermal insulation of buildings. Ceiling height, external wall thickness etc.

2. Town Planning

a. **General.** Definitions, trends in urban growth, objectives of town planning, modern planning in Pakistan and abroad.

b. **Preliminary Studies.** Study of natural resources, economic resources, legal and administrative problems, civic survey, preparation of relevant maps.

c. **Land Use Patterns.** Location of parks and recreation facilities, zoning an its aspects, public and semi public building, civic centres, commercial centres, local shopping centres, public schools, industrial area and residential areas.

d. **Street Pattern.** Layout of streets, road crossings and lighting. Community planning.

e. **City Extension and Master Planning.** Suburban development, neighborhood unit, satellite towns and garden cities. Introduction to master planning.

f. **Urban Planning.** Inner city urban designs, Up-gradation of square/scattered settlements.

Books Recommended:

1. Architecture in Pakistan, Kamal Khan Mumtaz, 1st edition Concept Media Ltd, Singapore, 1985.
2. Architecture History, John Mosgrove, 19th edition Butterworth, 1987.
3. Urban and Regional Planning, Peter Hall, 5th edition Billing and Sons Ltd London, 1989.
4. Town Planning, S C Rangwala, 3rd edition Farooq Kitab Ghar, Karachi, 1989.

8th SEMESTER

CT- 406   REPAIR AND MAINTENANCE OF STRUCTURES

Contents:

1. Introduction to different types of failures in building structures and their   causes.
2. Assessment of damage by different methods including non-destructive methods.
3. Introduction to Rules and Regulations of Maintenance.
4. Repair and Maintenance Measures.

CT-407   PAVEMENTS AND FOUNDATIONS

PAVEMENTS

Types of pavement, wheel loads, load distribution characteristics. Design considerations. Methods of design of pavements, group index method, CBR method, Westergaurd method, ORN-31 method, AASHTO design guide method. Construction and maintenance Pavement evaluation and rehabilitation.

FOUNDATIONS

Definition, purpose and types, general requirements of foundations, depth of footings, selection of foundation types. Geotechnical design of isolated, combined, mat and strap foundations. Differential settlements and cracks. Proportioning of footings for given settlements. Introduction to deep foundations. Types of piles, load carrying capacity of piles. Group action, negative skin friction, pile load test.

Bearing Capacity of Soils: Definition of ultimate and safe bearing capacities, allowable bearing capacity, gross and net bearing capacities, Methods of obtaining bearing capacity:
* Presumptive values from codes; merits and demerits,

* From plate toad test,
* Bearing capacity theories,
* Bearing capacity from SPT and CPT data.

Settlement Analysis: Definition, total settlement, differential settlement, elastic or immediate settlement. Immediate settlement of cohesive and non-cohesive soils. Causes of settlements and methods of controlling settlement. Limits of allowable, total and differential settlement.

CT-408   PRE-STRESSED AND PRE-CAST CONCRETE TECHNOLOGY

Obiectives

i)   To develop a basic understanding of the properties of steel and concrete to be used in pre-stressed concrete structures.
ii)   To analyze the behaviour of pre-stressed concrete members.
iii)   To study casting of pre cast & pre stressed concrete members.

Description

The course is of practical nature and describes methods of pre-stressing, analyses and design of pre-stressed concrete members for flexure, shear, bond and bearings. Design and construction of pre-cast units, joints of precast elements and execution details are also provided.

Contents

> **Introduction:** Materials, pre-stressing system, end anchorages, prestress losses, methods of pre-stressing, pre-tensioning and post-tensioning procedures. Merits and demerits of Prestressing.
>
> > (4 Weeks)

> **Design:** Analysis and design of pre-stressed concrete members for flexure, shear bond and bearings. Ultimate strength, composite sections, beam deflection and layouts. Steel strands, tendon layouts.
>
> > (6 Weeks)

> **Precast Units:** Shapes of precast units, single tee, double tee and hollow core-sections. Design aids, load tables, design of precast units, casting and curing of units. Typical joints for precast elements. Erection methods, precast units and their specifications.
>
> > (5 Weeks)

Practical

1- A general study of essential equipment for precast concrete industry [4].
2- Making form work for precast concrete members and grills and casting of the specimens. Background, theory & instruction [3], experiment [1], discussion and report [3].
3- Study of equipment and machinery for prestressed concrete industry [5].
4- Casting and testing of specimens of prestressed concrete units. Background, theory & instruction [3], experiment [1], discussion and report [3].
5- Casting and testing of specimens of precast RC concrete units. Background, theory & instruction [3], experiment [1], discussion and report [3].

Text Books

1- Prestressed Concrete Structures by T. Y. Lin, Ned H. Burns, (Latest Edition).

Reference Books

PCI Design Handbook: Precast & Prestressed Concrete by Precast/Prestressed Concrete Institute, (Latest Edition).
Prestressed Concrete Design by Computer by R. Hulse, W.H. Mosley, (Latest Edition).
Introduction to Prestressed Concrete Vol. I by B. W. Abeles (Latest Edition).
Prestressed Concrete by Khachaturain (Latest Edition).
Prestressed Concrete Beams Design and Logical Analysis by Nilby (Latest Edition).
Prestressed Concrete for Architects Engineers by H. Kent. Preston (Latest Edition).
Modern Prestressed Concrete by James R. Libby (Latest Edition).

CT-409   **PROJECT**

Aims

To develop the ability of exercising the B-Tech (Hons) program in the analysis and design of construction/highway projects.

Contents

The project involves survey, analysis and design of Civil Engineering project. The student in close consultation with department faculty will complete the project using Library, Computer or Laboratory facilities. Progress reports and a comprehensive written report are required.

CT-410   PRACTICAL FIELD TRAINING & REPORTING SUBMISSION-IV

(Students will be assigned practical jobs at the end of which report will be submitted)